State of Science for the Bay-Delta System Report
DRAFT Outline
8/01/06

Purpose: To provide a science overview of the CALFED Bay Delta Program to inform decision making and future Delta management under changing conditions.

Scope: This report will provide a broad interdisciplinary context and describe relevant scientific information for the Bay-Delta system. Areas of focus will include:

- State of scientific knowledge
- State of the system (trends/indicators)
- Recommended future science actions/activities for the CALFED Program as a whole, and specifically for the CALFED Science Program
- Critical certainties and uncertainties
- Specific interrelationships between and among:
    - Delta hydrodynamics
    - Water quality
    - Ecosystem
    - Levees
    - Water management

Report Outline:

I. Executive summary

II. Current system overview
    1. What we have learned about how the system works in terms of physical, biological, chemical aspects and their interrelationships
    2. What is the status (indicators)

III. Future changing forces
    1. Critical certainties (first-order drivers of change)
        - Population growth
        - Subsidence
        - Seismicity
        - Sea level rise
        - Regional climate change
        - Invasive species
    2. Critical uncertainties (both drivers and system responses)

IV. Recommended next steps

Technical Appendix Outline:

I. Water Resource Management- *How we manage and operate water resources and infrastructure to meet water supply needs.*

1. Identify Needs
   - Drinking, Agriculture, Environment, Recreation
2. Water Supply
   - Operations- facilities, regulations, allocation
   - Constraints/Considerations on Operations
     - Water Quality Elements- DOC, salinity etc.
     - Environment and Fish Protection- programs, invasives, salvage, studies
   - Changing Forces on Operations
     - Increased Demand- efficiency, improve water quality, increase storage
     - Climate Change- discuss the factors and ecosystem effects
   - Demand Management- current approaches and obstacles
3. Conveyance and Flood Protection
   - Levees for Conveyance and Flood Protection- management and environmental impact
   - Other facilities/elements and their impact- reservoirs, floodplains etc.
   - Constraints/Considerations- regulations and habitat protection
   - Changing Forces- catastrophic events, land use changes, pests

II. Physical setting and hydrology- *How land use and the physical setting of the watershed affect the quantity, quality and timing of the water for beneficial uses such as water supply reliability, ecosystem health, water quality, and flood control.*

1. Watershed and Hydrologic Characteristics
   - Geology, climate, precipitation
   - History of watershed & hydrologic alterations
   - Current land use & trends
   - Functional connections to landscape affect quantity, quality and timing of water in the stream: (groundwater, runoff, snow pack)
   - Interannual, seasonal variability of flows
   - Geomorphic alterations: dams, diversions, floodplains, dredge tailings
2. Current knowledge of relationship of physical setting/ hydrology to beneficial uses
   - Water Supply reliability (matching supplies with demands)
   - Flood control (flood events, flood management)
   - Ecosystem (processes, habitat, floodplain restoration)
   - Water Quality (non-point source pollution, ag drainage, groundwater)
3. Changing forces – potential implications
   - Climate change
   - Changes in land use / watershed characteristics
   - Changes in water resource demands and management

III. Delta Hydrodynamics- *The drivers of Delta hydrodynamics and the data, models, and forecasts of the effects of hydrodynamic changes.*

1. System effects on hydrodynamics
   - Freshwater Inflows
   - Ocean Conditions
   - Meteorological Conditions
   - Bathymetry

- Water Management
- Influence of Human Activities

2. Hydrodynamic effects on water quality and biological systems
   - Salinity
   - Biological Systems
3. Hydrodynamic Models
   - 1D, 2D, 3D
   - Particle Tracking, Finger Printing
   - Response to Future Conditions
   - Future Models
4. Monitoring
   - Stage
   - Velocity
   - Salinity
5. Hydrodynamic studies
   - Ongoing
   - Future

IV. Water Quality- *How water quality affects ecosystem and drinking water supplies.*

1. Ecosystem Water Quality
   - Bioaccummulative- Mercury, Selenium, Organochlorine pesticides
   - Toxicity- Non-bioaccumulative metals, Currently used pesticides, Toxicity of unknown origin, Sediment toxicity
   - Dissolved Oxygen
   - POD Water Quality Issues- Microcystis, Pyrethroid pesticides, Herbicides
2. Drinking Water Quality
   - Organic Carbon/ Disinfection Byproduct Precursors
   - Salinity
   - Nutrients
   - Pathogens

V. Aquatic and Terrestrial Ecosystems- *How urbanization, water management, and system manipulation has changed ecosystem function, available habitat and related resources for selected species.*

1. Habitats
   - Open water
   - Wetlands
   - Terrestrial
   - Trends
   - Integration
2. Food Webs
   - Open Water
   - Wetlands Organisms
   - Terrestrial Organisms
   - Invasive/Exotic Species and Ecosystem effects
   - Trends
   - Integration
3. Fisheries
   - Key Species (Regulatory Importance)
   - Species of Known Biology (Ecological Importance)

- Other Species of Concern
- Statement on Trends

VI. Introduced Species/Invasives- *How introduced species have affected the Bay Delta System in the past and the uncertainty that surrounds them in the future.*

1. Introduction
   - Global loss of biodiversity
   - Non Indigenous Species (NIS) in the US
   - Invasives in the San Francisco Bay and Delta System
2. Current State of Invasives in the Delta System
   - Whose here already and how has their presence affected the system
     - Aquatic Species, Terrestrial Species- include species info, species impacts/interactions, species responses to system changes
   - Emerging Science – include ballast water and fouling organism science, education and outreach efforts
3. Current Trends and Monitoring
   - Current information on trends
   - Data/monitoring
   - Synthesis and integration of information
4. Drivers of Change
   - Certainties and Uncertainties
5. Recommended Next Steps

VII. Data Integration and Syntheses- *What data are available and at what cost, how are data being synthesized and managed, and what are the significant continuing gaps.*

1. Data Availability and Access
2. Synthetic Efforts
3. Significant Gaps

VIII. CALFED-funded research projects

To be included in each appendix (in approximately 20 pages):

1. Summary/state of knowledge
   - what we know (peer-reviewed science)
   - integration/inter-relationships
   - emerging science
   - gaps/uncertainties
2. State of system/trends/indicators
   - current information on trends
   - gaps in data/monitoring
   - gaps in synthesis and integration
3. Drivers of change (critical certainties and uncertainties)
4. Recommended next steps
5. References